(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 591 537 A1**

(12) **EUROPEAN PATENT APPLICATION published in accordance with Art. 158(3) EPC**

(21) Application number: **92913390.8**

(22) Date of filing: **26.06.92**

(86) International application number: **PCT/JP92/00811**

(87) International publication number: **WO 93/00689 (07.01.93 93/02)**

(51) Int. Cl.5: **H01C 7/02**, H01C 1/084, H05B 3/14

(30) Priority: **26.06.91 JP 57211/91 U**
26.06.91 JP 57212/91 U

(43) Date of publication of application: **13.04.94 Bulletin 94/15**

(84) Designated Contracting States: **FR GR IT**

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(54) **THERMISTER DEVICE OF POSITIVE CHARACTERISTIC.**

(57) A thermister (2) of a positive characteristics is so disposed in a recessed section that one of the two principal faces facing each other faces a bottom section (11) of a case (1) and the other faces an opening face (12) opposed to the bottom section (11). A heat radiation member (5) has flat thermally-coupling sections (52) and a heat radiation cylindrical body (51) which is provided at least on one of the sides of the case (1), i.e. on the bottom section (11) side and the opening face (12) side and which is in surface contact with the side. Thereby, the efficiency of thermal conduction from the thermister (2) of a positive characteristic to the heat radiation cylindrical bodys (51) is improved.

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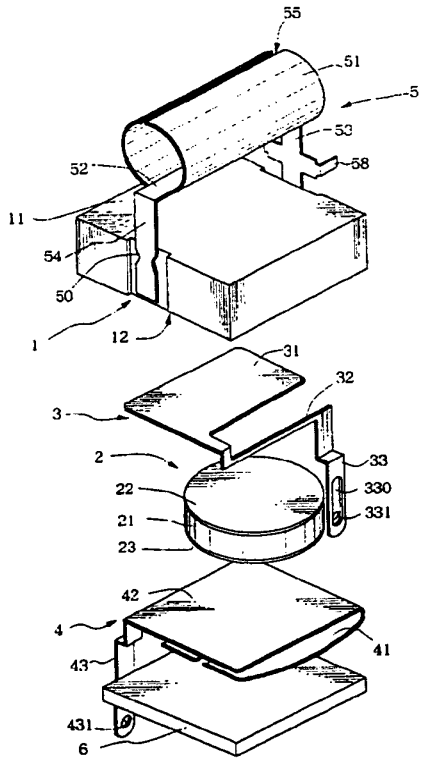
FIG. 1



TECHNICAL FIELD

This invention relates to positive characteristic thermistor devices used for liquid type electric mosquito destroyers or the like.

BACKGROUND ART

In a liquid type electric mosquito destroyer, vapor of a liquid insecticide is dispersed from a liquid withdrawal wick, in which the liquid insecticide is permeated by the capillary phenomenon, by heating the periphery of the wick. For heating the liquid withdrawal wick, a positive characteristic thermistor device is used. Japanese Utility Model Application Laid-Open No. 129794/1987 discloses a pertaining positive characteristic thermistor device, which comprises a case, a positive characteristic thermistor, electrode terminals and a heat radiation member. The case has a recess, which is open opposite the bottom thereof. The positive characteristic thermistor has electrodes provided on its opposite side surfaces, and it is disposed in the recess such that the electrodes are directed toward the bottom and the opening of the recess, respectively.

The electrode terminals are overlapped on the respective electlode of the positive characteristic thermistor and led out to the outside through the bottom of the case. The heat radiation member is disposed on the opening side of the case via an electric insulator member. The heat radiation member has a flat heat collector and a cylindrical heat radiator, the heat collector being disposed on the electric insulator member and thermally coupled via the same to the positive characteristic thermistor. The cylindrical heat radiator, in which a liquid withdrawal wick is inserted, is provided as a portion of the heat collector led out to the outside of the case.

According to this prior art, it is possible to provide a liquid type electric mosquito destroyer, in which the outer periphery of the liquid withdrawal wick permeated by the liquid insecticide is heated with the cylindrical heat radiator.

In this type of positive characteristic thermistor device, it is necessary to elevate the temperature of the cylindrical heat radiator accommodating the liquid withdrawal wick thereon up to a temperature required for the thermal dispersion of the liquid chemical. On the other hand, the switching temperature of the positive characteristic thermistor is desirably as low as possible. The lower the switching temperature required for the positive characteristic thermistor, such advantages are obtainable that it is possible to use the smaller size positive characteristic thermistor and that the power consumption is the lower.

However, with the above prior art positive characteristic thermistor device the cylindrical heat radiator is provided on a portion of the heat collector that is led to the outside of the case, and therefore it imposes a limitation on the improvement of the efficiency of heat conduction from the heat collector to the hear radiator. In order to ensure the necessary heat generation temperature of the cylindrical heat radiator, it is necessary to use a positive characteristic thermistor with a high switching temperature, typically about 220 °C. Therefore, limitations have been imposed on the reduction of the size and power consumption of the positive characteristic thermistor. A positive characteristic thermistor with a switching temperature of 220 °C roughly has a diameter of about 10 mm and a thickness of about 3 mm and consumes power of about 3.9 W.

DISCLOSURE OF THE INVENTION

An object of the invention is to provide a positive characteristic thermistor device, which has a high efficiency of heat conduction from positive characteristic thermistor to cylindrical heat radiator and is suited for reduction of the size and power consumption.

To attain the above object of the invention, the positive characteristic thermistor according to the present invention comprises an outer fitting being made of an electric insulator material, a positive characteristic thermistor being accommondated in and thermally coupled to the outer fitting, electrode terminals being connected to electrodes of the positive chracteristic thermistor in the outer fitting and led out to the outside thereof, and a heat radiator having a cylindrical heat radiation member, the cylindrical heat radiation member having a flat heat coupling portion in surface contact with a outer surface of the outer fitting.

With the positive characteristic thermistor accommodated in and thermally coupled to the outer fitting, heat generated in the thermistor is transmitted to the outer fitting. Since the heat radiator includes the cylindrical heat radiation member having the flat heat coupling portion in surface contact with an outer surface of the outer fitting, heat generated in the positive characteristic thermistor is efficiently transmitted to the cylindrical heat radiation member via the flat heat coupling portion in surface contact with the outer surface of the outer fitting. Thus, the efficiency of heat conduction from the positive characteristic thermistor to the cylindrical heat radiation member, in which a liquid withdrawal wick for withdrawing a liquid chemical, is increased. It is thus possible to use a positive characteristic thermistor, the switching temperature of which is low, and which is small in size and

consumes low power.

Further, since the outer fitting is made of an electric insulator material, in which the positive characteristic thermistor is accommodated, it is possible to obtain reliable electric insulation and protection of the positive characteristic thermistor.

Further, since the electrode terminals are connected to the positive characteristic thermistor inside the outer fitting and led out to the outside thereof, it is possible to supply power to the thermistor through the electrode terminals without possibility of spoiling the electric insulation and protection functions with respect to the positive characteristic thermistor.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an exploded perspective view showing an essential part of a positive characteristic thermistor device according to the invention;

Fig. 2 is a sectional view showing the positive characteristic thermistor device according to the invention in the assembled state;

Fig. 3 is a plan view showing the positive characteristic thermistor device according to the invention in the assembled state;

Fig. 4 is a bottom view showing the positive characteristic thermistor device according to the invention in the assembled state;

Fig. 5 is a view showing the positive characteristic thermistor device according to the invention in use;

Fig. 6 is a perspective view showing a specific example of heat radiator used for the positive characteristic thermistor device according to the invention;

Fig. 7 is a sectional view showing the specific example of heat radiator used for the positive characteristic thermistor device according to the invention;

Fig. 8 is an exploded perspective view showing a different embodiment of the positive characteristic thermistor device according to the invention;

Fig. 9 is a sectional view showing the different embodiment of the positive characteristic thermistor device according to the invention;

Fig. 10 is an enlarged-scale perspective view showing the different example of the heat radiator used for the positive characteristic thermistor device according to the invention;

Fig. 11 is a sectional view showing a heat radiator in the different embodiment of the positive characteristic thermistor device according to the invention;

Fig. 12 is a plan view showing a further embodiment of the positive characteristic thermistor device according to the invention; and

Fig. 13 is a sectional view showing a further embodiment of the positive characteristic thermistor device according to the invention.

BEST MODE FOR CARRYING OUT THE INVENTION

Referring to Figs. 1 to 7, designated at 1 is a case, at 2 a positive characteristic thermistor, at 3 and 4 paired electrode terminals, at 5 a heat radiator, at 6 a lid, and at 7 a mounting member.

The case 1 and lid 6 are made of an electric insulator material and constitute an outer fitting. The case 1 has a recess 13 having a bottom 11 and an opening 12 thereopposite. It is made of an electric insulator material excellent in the thermal conductivity and chemical resistance, for instance alumina. Its bottom 11 is constituted by a sealed wall free from any pore, hole or aperture. The lid 6 closes the opening 12 of the case 1.

The positive characteristic thermistor 2 is accommodated in the case 1 constituting the outer fitting and thermally coupled to the outer fitting. It comprises a disk-like element 21 with electrodes 22 and 23 provided on its opposite side surfaces, being disposed in the recess 13 such that the electrodes 22 and 23 are directed toward the bottom 11 and opening 12, respectively. The positive characteristic thermistor 2 may have a circular, rectangular or any other shape.

The electrode terminals 3 and 4 are connected in the outer fitting constituted by the case 1 and the lid 6 to the respective electrodes 22 and 23 of the positive characteristic thermistor 2 and led out to the outside of the outer fitting. They are overlapped over the respective electrodes 22 and 23 of the positive characteristic thermistor 2 in the recess of the case 1 and led out to the outside of the outer fitting from the opening 12. They are desirably made from a thin plate of such metal as stainless steel. Of the electrode terminals 3 and 4, the electrode terminal 3, which is in contact with the electrode 22 disposed on the side of the bottom 11 of the case 1, has an electrode contact portion 31, a narrow portion 32 and a terminal portion 33. The electrode contact portion 31 is flat. The narrow portion 32 extends along and at a spacing from one edge of the electrode contact portion 31 and has one end joining the same portion 31. It is adapted to be broken by an over-current. Thus, the electrode terminal 3 is made from a thin plate corresponding to an over-current breakage value. The terminal portion 33 is bent like a crankshaft. It extends in a direction substantially normal to the surface of the electrode contact portion 31 and has one end joining the other end of the narrow portion 32. It has a raised portion 330 raised from one side toward the other side. The raised portion 330 has a

hole 331 near an end of it.

The electrode terminal 4 is disposed on the side of the opening 12 and in contact with the electrode 23. It has a spring portion 41 and a flat portion 42. The flat portion 42 is held in forced contact with the electrode 23 by making use of the spring pressure of the spring portion 41. A terminal portion 43, bent like a crankshaft, extends from an edge of the flat portion 42. It has a hole 431 near its other end. The electrode terminal 4, unlike the electrode terminal, is not adapted to be broken by any over-current. Thus, it is usually thick compared to the electrode terminal 3.

The heat radiator 5 has a cylindrical heat radiation member 51, which has a flat heat coupling portion 52 disposed on the side of and in surface contact with the bottom 11 of the case 1 constituting the outer fitting. Thus, heat generated in the positive characteristic thermistor 2 is efficiently transmitted to the cylindrical heat radiation member 51 through the flat heat coupling portion 52. A thermally conductive resin such as a silicone resin is desirably provided between the heat coupling portion 52 and the bottom 11.

Referring to Figs. 6 and 7, the heat radiator 5 is formed by using a plate of a good heat conductor metal, for instance an aluminum plate. It has folding portions 53 and 54 extending from its opposite ends. The folding portions 53 and 54 are adapted to embrace the case 1 by being folded toward the side of the opening 12. The cylindrical heat radiation member 51 has an axial slit 55. The slit 55 is formed as narrow as possible in order to provide for a constant heat distribution in the cylindrical heat radiation member 51. The folding portion 54 has a notch 50 formed in one or each edge of it (see Fig. 1). The portion formed with the notch or notches 50 is utilized as a bending portion. The other folding portion 53 of the heat radiator 5 has arm portions 58 extending from its opposite edges.

The lid 6 is disposed such as to close the opening 12 of the case 1. It is received in a stepped portion formed around the recess 13 of the case 1. The terminal portions 33 and 43 of the electrode terminals 3 and 4 are led out to the outside of the outer fitting through a gap formed in the stepped portion between the lid 6 and case 1. The contact surfaces of the lid 6 and case 1 and also the gap forming portions thereof, through which the terminal portions 33 and 43 are led out, are sealed to one another using a heat-resistant resin or the like. The mounting member 7 has through holes, and it is secured to the heat radiator with the arm portions 58, which penetrate the through holes noted above. The mounting member 7 is made from a plate of stainless steel or like metal having high mechanical strength and excellent chemical resistance.

In assembling, the electrode terminal 3 is first disposed in the recess 13 of the case 1, i.e., on the inner surface of the bottom 11, and then the positive characteristic thermistor 2, electrode terminal 4 and lid 6 are stacked in the mentioned order on the electrode terminal 3. The heat radiator 5 is disposed on the outer surface of the bottom 11 of the case 1, and the folding portions 53 and 54 are folded to be secured to the outer surface of the lid 6, whereby the components are elastically supported and secured by the elastic force of the electrode terminal 4. Then, the mounting member 7 is coupled to the heat radiator 5 using the arm portions 58.

The folding portions 53 and 54 are retreated in their portions corresponding to the electrode terminals 3 and 4 by Δ D1 and Δ D2 in a direction of increasing their distances D1 and D2 from the electrode terminals 3 and 4.

Fig. 5 is a view showing the positive characteristic thermistor device according to the invention in use.

A liquid withdrawal wick 8 for withdrawing an insecticide or the like, is inserted in the cylindrical heat radiation member 51. When the liquid withdrawal wick 8 is heated from around it, it thermally disperses an insecticidal component. The lower end of the liquid withdrawal wick 8 is dipped in a liquid insecticide container (not shown).

As shown, since the positive characteristic thermistor 2 is accommodated in and thermally coupled to the outer fitting constituted by the case 1 and lid 6, heat generated in the thermistor 2 can be reliably transmitted to the outer fitting 1. In addition, since the heat radiator 5 has the flat heat coupling portion 52 in surface contact with the outer surface of the bottom 11 of the case 1 constituting the outer fitting, heat generated from the positive characteristic thermistor 2 can be efficiently transmitted to the cylindrical heat radiation member 51. Thus, high efficiency of heat conduction from the thermistor 2 to the cylindrical heat radiation member 51 with the liquid withdrawal wick inserted therein is increased. It is thus possible to use as the positive characteristic thermistor 2 one which is switched at a low switching temperature, has a small size and consumes low power. As an example, it was possible to use as the positive characteristic thermistor one having a switching temperature of 180 °C, lower than the prior art switching temperature of 220 °C by 40 °C, having a diameter of 7 mm and a thickness of 3 mm and consuming power of 2.8 W.

Further, since the case and lid 6 of the outer fitting accommodating the positive characteristic thermistor 2 is made of an electric insulator material, it is possible to reliably electrically insulate and protect the thermistor 2.

Further, since the electrode terminals 3 and 4 are connected inside the outer fitting constituted by the case 1 and lid 6 to the electrodes 22 and 23 of the positive characteristic thermistor 2 and led out to the outside of the outer fitting, it is possible to supply power to the thermistor 2 through the electrode terminals 3 and 4 without possibility of spoiling the electric insulation and protection functions with respect to the thermistor 2.

Further, since the positive characteristic thermistor 2 has its electrodes 22 and 23 provided on its opposite principal surfaces and is disposed in the recess 13 of the cases 1 such that its principal surfaces are directed toward the bottom 11 and the opening 12 of the case, respectively, heat generated in the positive characteristic thermistor 2 is mostly radiated toward the side of the bottom 11 and the opposite side of the opening 12 of the case 1.

Further, since the electrode terminals 3 and 4 are led out to the outside of the outer fitting through the opening 12, there is no need of forming any hole or aperture in the bottom 11 of the case 1 for leading the electrode terminals 3 and 4 through the bottom 11, and the bottom 11 is perfectly sealed. Since the cylindrical heat radiation member 51 of the heat radiator 5 is disposed on the outer surface of this sealed bottom 11, it is possible to perfectly prevent the liquid chemical, which is dispersed or dripped from the liquid withdrawal wick 8 inserted in the cylindrical heat radiation member 51 of the heat radiator 5, from intruding into the recess 13 of the case 1. It is thus possible to prevent deterioration of the positive characteristic thermistor 2 due to intrusion of liquid chemical and thus ensure enhanced reliability.

Further, since the heat radiator 5 is retreated in its portions corresponding to the electrode terminals 3 and 4 by $\Delta D1$ and Δ D2 in the direction of increasing its distance from the electrode terminals 3 and 4, it is possible to improve the electric insulation between the electrode terminals 3 and 4 and heat radiator 5 and thus ensure enhanced reliability.

Further, the electrode terminal 3 has such a structure that its electrode contact portion 31 in surface contact with the electrode 22 of the positive characteristic thermistor 2 and its terminal portion 33 are united together by the narrow portion 32, which extends along and at a spacing from one edge of the contact portion 31 and is adapted to be broken by an over-current. With deterioration of the Positive characteristic thermistor 2, an over-current flows in it under a thermal equilibrium condition, under which intrinsically a low current should flow. Such over-current causes damage or abnormal heat generation to the positive characteristic thermistor 2 and a possible fire accident resulting therefrom, and is thus very hazardous. Accordingly, in this embodiment the electrode terminal 3 is provided with the narrow portion 32 which is adapted to be broken by an over-current, thus providing protection against over-current.

The case 1 has another recess 14, which is distinct from the recess 13 and is formed such as to correspond in position to the narrow portion 32 of the electrode terminal 3. In assembling, the narrow portion 33 of the electrode terminal 3 is located in the recess 14, and both the recesses 13 and 14 are then closed by the lid 6. With this structure, when the narrow portion 32 is broken by an over-current, the molten metal is retained in the recess 14 and not spattered into the inside of the recess 13, in which the positive characteristic thermistor 2 is accommodated. It is thus possible to eliminate a short-circuit between the electrodes 22 and 33 due to otherwise possible attachment of molten metal to the outer periphery of the positive characteristic thermistor 2. The narrow portion 32 is disposed such that it is spaced apart from the wall surfaces of the recess 14. With this arrangement, it is possible to suppress heat radiation from the narrow portion 32 and cause reliable breakage thereof with a predetermined breakage over-current level.

The terminal portion 33 of the electrode terminal 3 has the raised portion 330 raised from one side toward the other side. With this arrangement, it is possible to make the thickness of the electrode terminal 3, which has to use a thin plate corresponding to the breakage over-current level, and the thickness of the electrode terminal 4 which does not, substantially identical with the raised portion 330. Thus, it is possible to connect identical terminals to the electrode terminals 3 and 4 for the connection thereof to external leads.

Besides, since the electrode terminals 3 and 4 have holes 331 and 431 formed near their end, a retaining structure may be formed with the connection terminals and holes 331 and 431.

Now, a modification of the above embodiment of the positive characteristic thermistor device according to the invention will be described with reference to Figs. 8 to 13. In the Figures, parts like those in Figs. 1 to 7 are designated by like reference numerals. In this modification, a heat radiator 5, as shown in Figs. 8 and 9, has a heat collection member 50 and a cylindrical heat radiation member 51. The heat collection member 50 is disposed in surface contact with the bottom 11, while the outer periphery of the cylindrical heat radiation member 51 is in contact with the surface of the heat collector 50. The heat radiator 5, as shown in Figs. 10 and 11, is made from a plate of a good heat conductor metal, for instance an aluminum plate, and it has positioning arm portions 56, secur-

ing arm portions 57, and arm portions 58 for securing mounting member, these portions extending from the heat collection member 50. The cylindrical heat radiation member 51 has a bent portion 53 extending from one end of it and joining the heat collection member 50, and its other end held by a folding member 54 extending from the heat collection member 50 and being folded back to be in contact with its inner periphery. Its flat heat coupling portion 52 extending substantially over its entire length is substantially in surface contact with the surface of the heat collection member 50. A thermally conductive resin such as a silicone resin is desirably provided between the heat coupling portion 52 and the heat collection member 50.

In the instance shown in Fig. 12, length of axial dimension of the cylindrical heat radiation member 51 is greater than in the case of Figs. 1 to 7 by Δ h, indicating that the amount of dispersion of the liquid chemical is adjsutable by adjusting the length of the cylindrical heat radiation member 51. The direction of the length adjustment may be on the side of the mounting member 7. The length adjustment may be in a direction of reducing the length.

In the instance of Fig. 13, the electrode terminal 4 is disposed on the side of the bottom 11 of the case 1, the positive characteristic thermistor 2, electrode terminal 3 and lid 6 are stacked in the mentioned order on the electrode terminal 4, and the heat radiator 5 is disposed on the opening side, on which the lid 6 is located. Although not shown, it is possible to dispose the cylindrical heat radiation member 51 on one side of the case 1.

INDUSTRIAL APPLICABILITY

As has been described in the foregoing, according to the invention the following effects can be obtained.

(a) Since the positive characteristic thermistor is accommodated in and thermally coupled to the outer fitting while the heat radiator has the flat heat coupling portion in surface contact with the outer surface of the outer fitting, it is possible to provide a positive characteristic thermistor device, which has high efficiency of heat conduction from the positive characteristic thermistor to the cylindrical heat radiation member and is suited for reducing the size and power consumption.

(b) Since the positive characteristic thermistor is accommodated in the outer fitting made of an electric insulator material, it is possible to provide a positive characteristic thermistor device, which can ensure reliable electric insulation and protection of the positive characteristic thermistor.

(c) Since the electrode terminals are connected within the outer fitting to the positive characteristic thermistor electrodes and led to the outside of the outer fitting, it is possible to provide a positive characteristic thermistor device, which permits power to be supplied to the positive characteristic thermistor via the electrode terminals without spoiling the electric insulation and protection functions with respect to the thermistor.

Claims

1. A positive characteristic thermistor device comprising :

   an outer fitting being made of an electric insulator material;

   a positive characteristic thermistor being accommondated in and thermally coupled to said outer fitting;

   electrode terminals being connected in said outer fitting to electrodes of said positive characteristic thermistor and led out to the outside thereof; and

   a heat radiator having a cylindrical heat radiation member, said heat radiation member having a flat heat coupling portion in plane contact with an outer surface of said outer fitting.

2. The positive characteristic thermistor device according to claim 1, wherein said outer fitting includes a case and a lid, said case having a bottom and a recess open opposite said bottom, said lid closing said opening of said case, said positive characteristic thermistor having electrodes provided on opposite principal surfaces and being disposed in said recess such that said principal surfaces are directed toward said bottom and said opening, respectively.

3. The positive characteristic thermistor device according to claim 2, wherein said cylindrical heat radiation member of said heat radiator is disposed on the outer surface of the bottom of said case.

4. The positive characteristic thermistor device according to claim 3, said cylindrical heat radiation member of said heat radiator has folding portions extending from each axial end of it, said folding portions being folded back such as to embrace said outer fitting.

5. The positive characteristic thermistor device according to claim 4, wherein said folding portions of said heat radiator have their portions corresponding to said electrode terminals re-

ceded in a direction of increasing their distance from said electrode terminals.

6. The positive characteristic thermistor device according to one of claims 1 to 5, wherein said heat radiator includes a heat collection member, said heat collection member being disposed on an outer surface of said outer fitting, the outer periphery of said cylindrical heat radiation member being in contact with a surface of said heat collection member.

7. The positive characteristic thermistor device according to claim 6, wherein said cylindrical heat radiation member has one end joined to said heat collection member and the other end held by a folding member extending from said heat collection member and folded to be in contact with its inner periphery.

8. The positive characteristic thermistor according to one of claims 1 to 5 and 7, wherein a thermally conductive resin is provided between said heat coupling portion and said outer fitting or said heat collection member.

9. The positive characteristic thermistor device according to claim 1, wherein two electrode terminals are provided as said electrode terminals, one of said electrode terminals having a portion to be broken by an over-current.

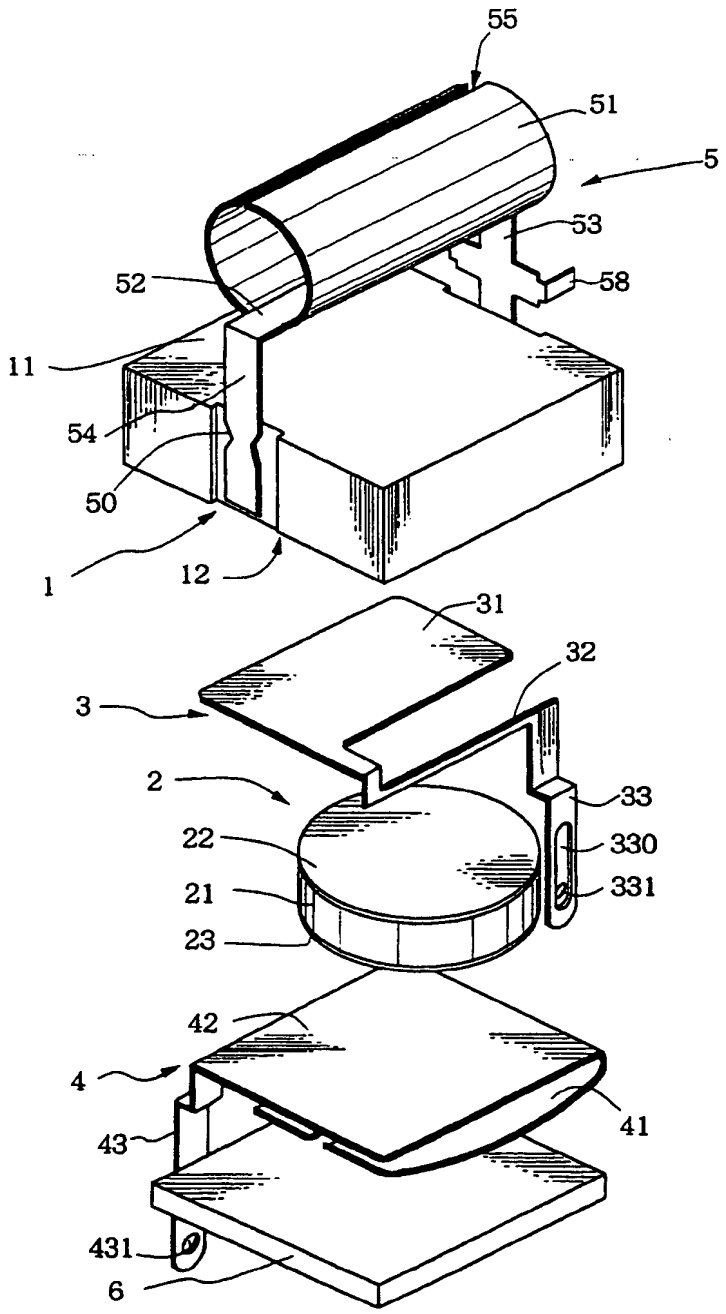
10. The positive characteristic thermistor device according to claim 9, wherein said one of said electrode terminals has a contact portion in surface contact with an electrode of said positive characteristic thermistor and a terminal portion led to the outside of said outer fitting, said portion to be broken by an over-current being a narrow portion joining together said contact portion and said terminal portion.

11. The positive characteristic thermistor according to claim 10, wherein said one of said electrode terminals has a thickness smaller than the thickness of said other electrode terminal, said terminal portion having a raised portion to provide for an substantialy uniform thickness.

12. The positive characteristic thermistor device according to claim 1, which further comprises a mounting member made from a metal plate, said mounting member being secured to said outer fitting via said heat radiator.

13. The positive characteristic thermistor device according to claim 12, wherein said heat radiator has at least one arm portion, said mounting member having a hole, said mounting member being secured with said arm portion fitted in said hole.

FIG. 1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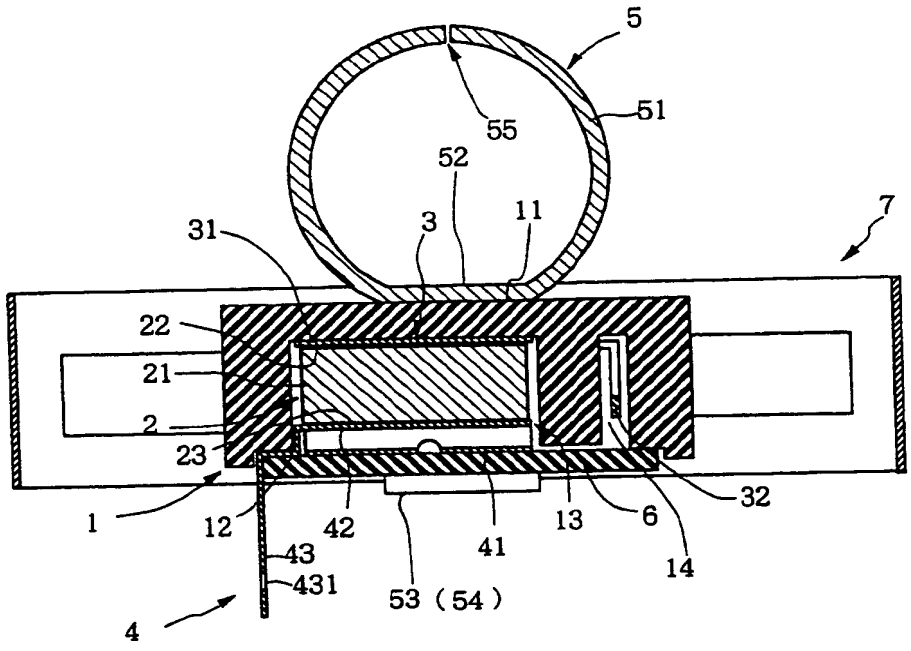

FIG. 3

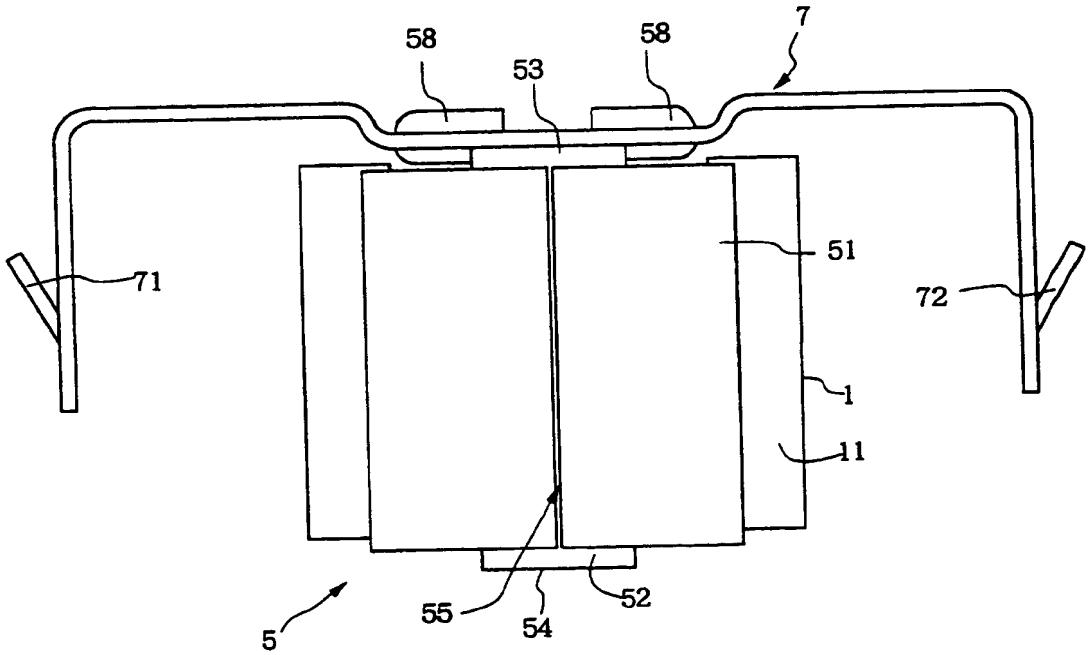

FIG. 4

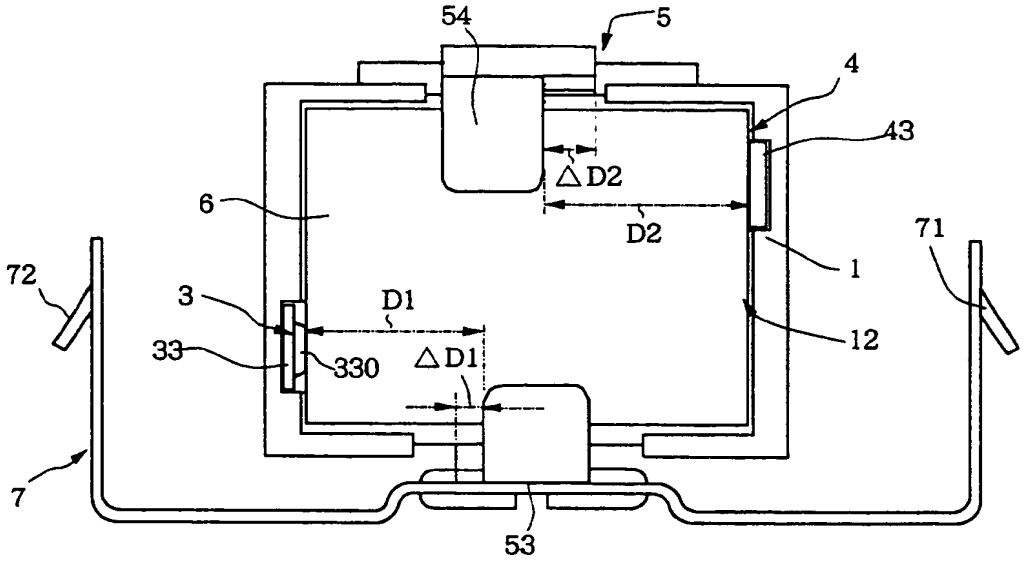

FIG. 5

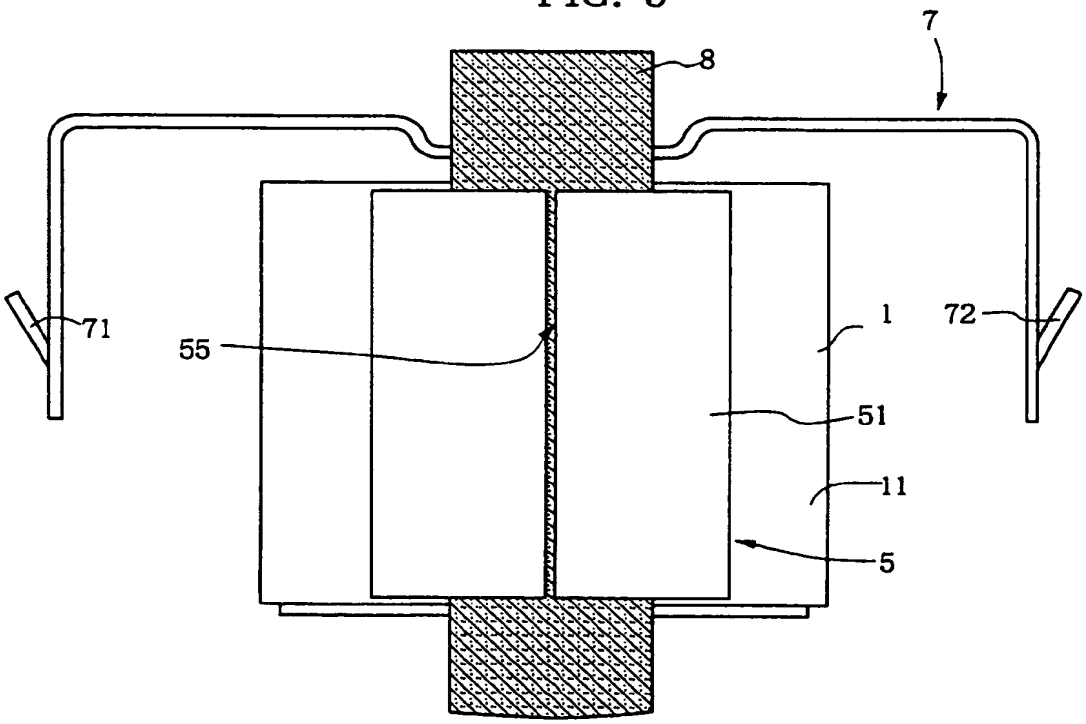

FIG. 6

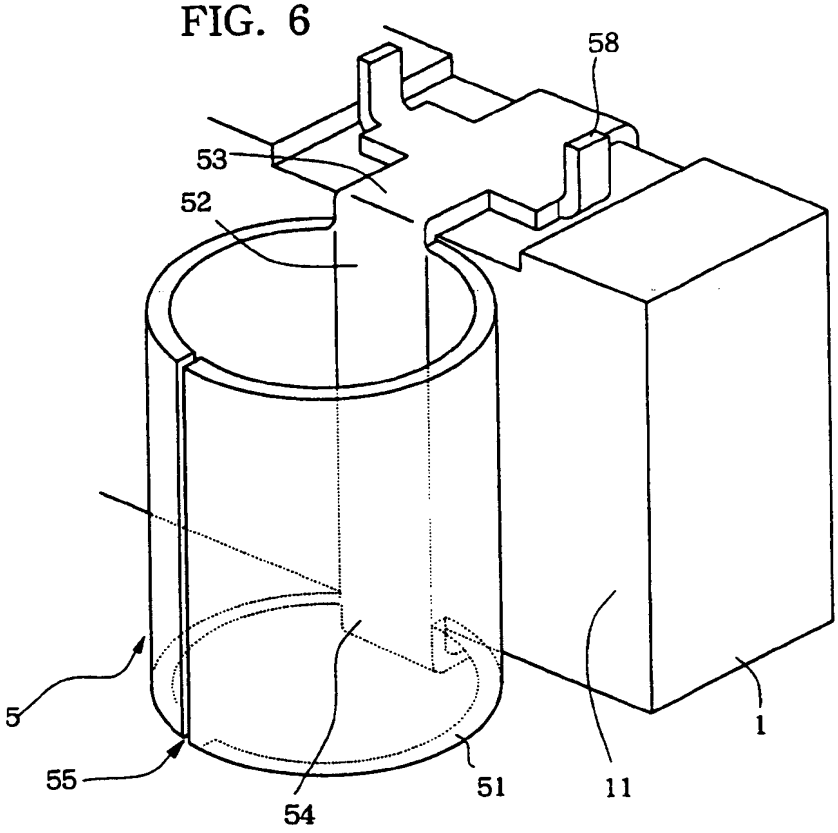

FIG. 7

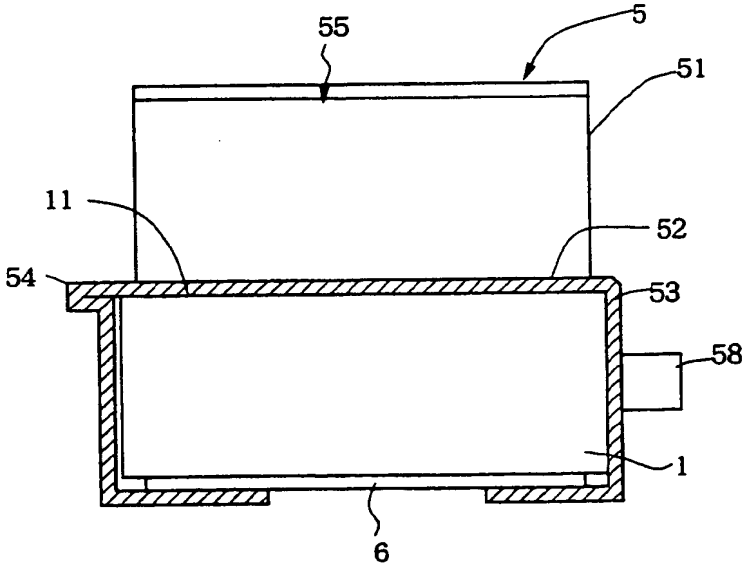

FIG. 8

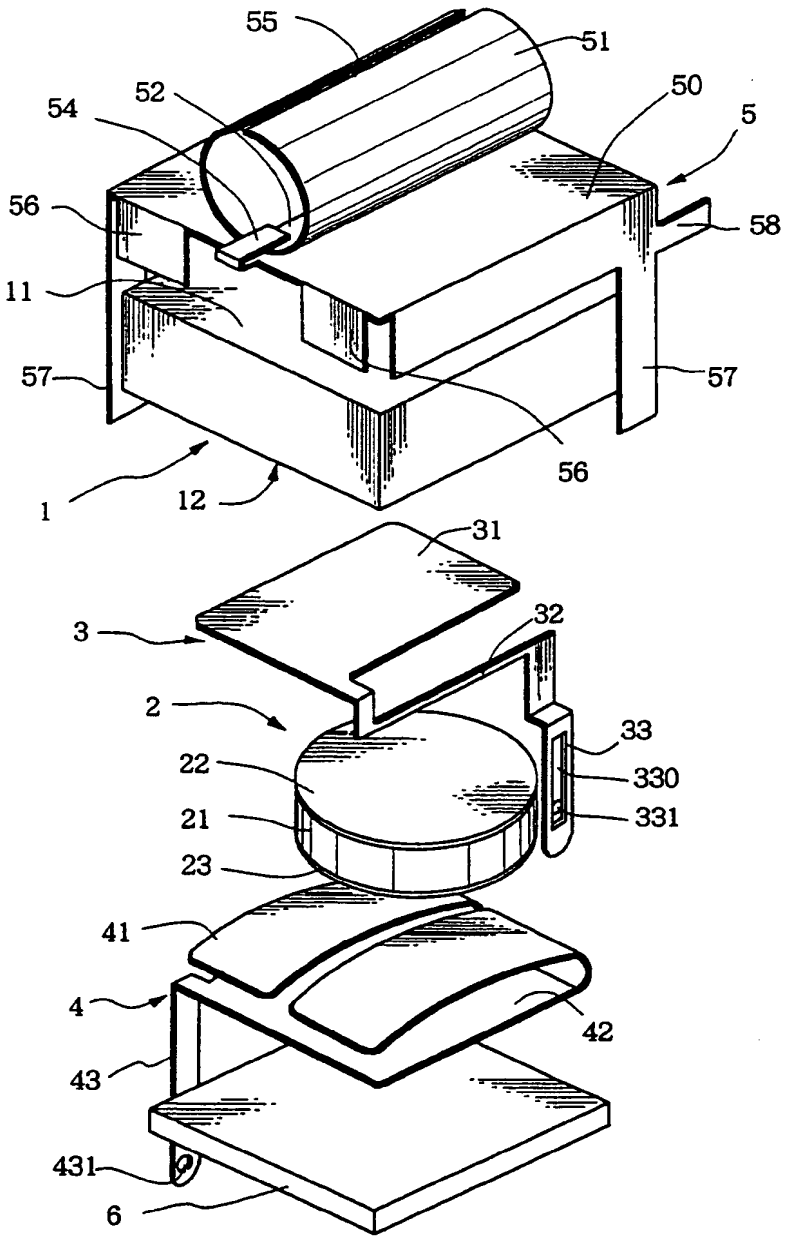
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FIG. 9

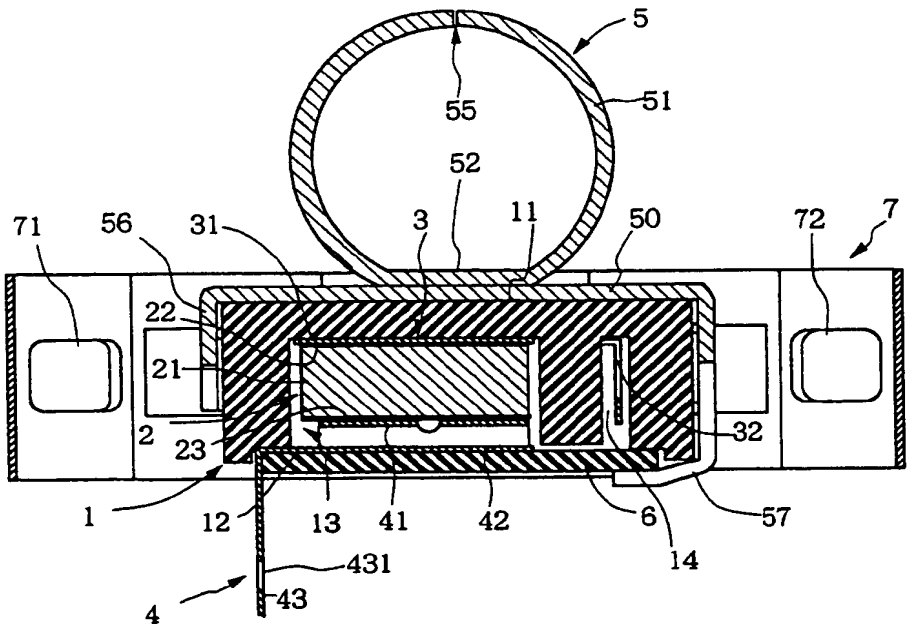


FIG. 10

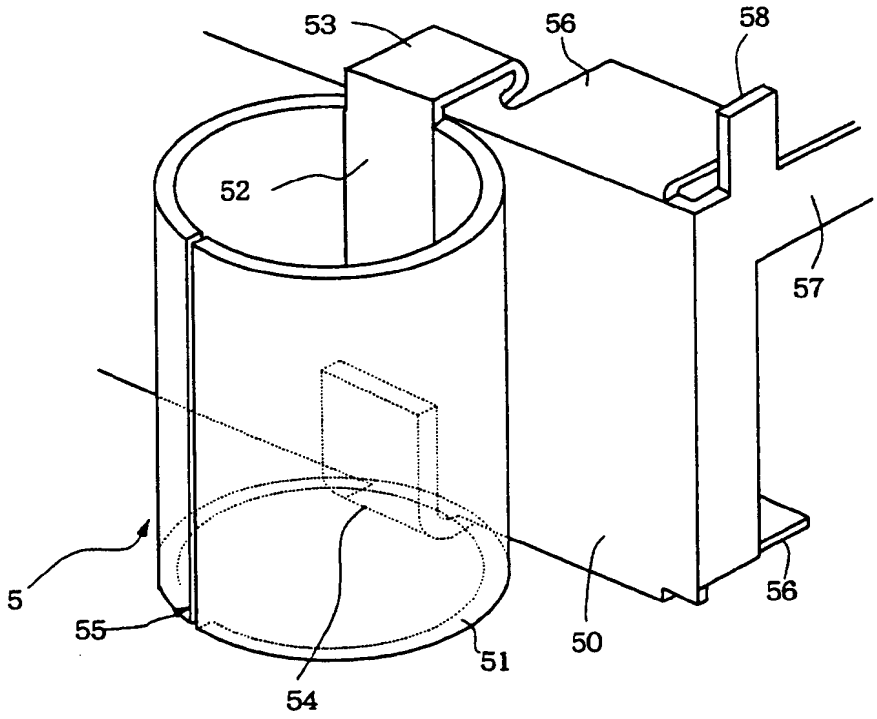


FIG. 11

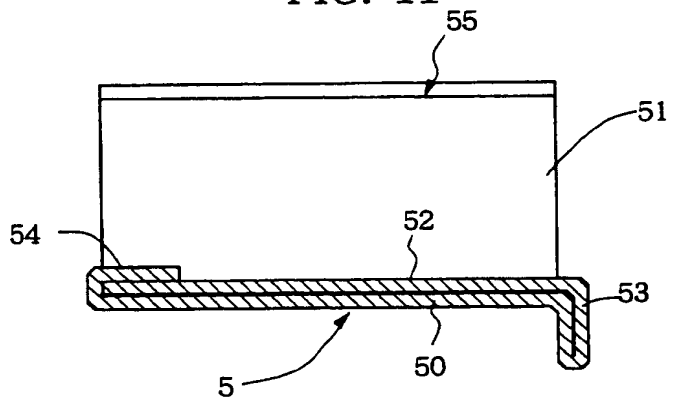


FIG. 12

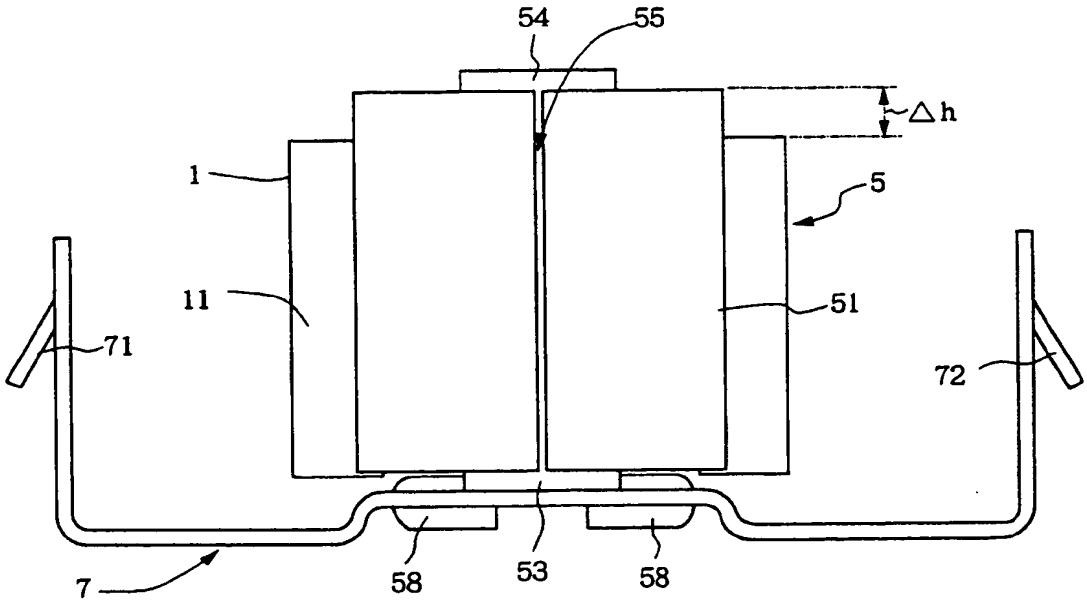
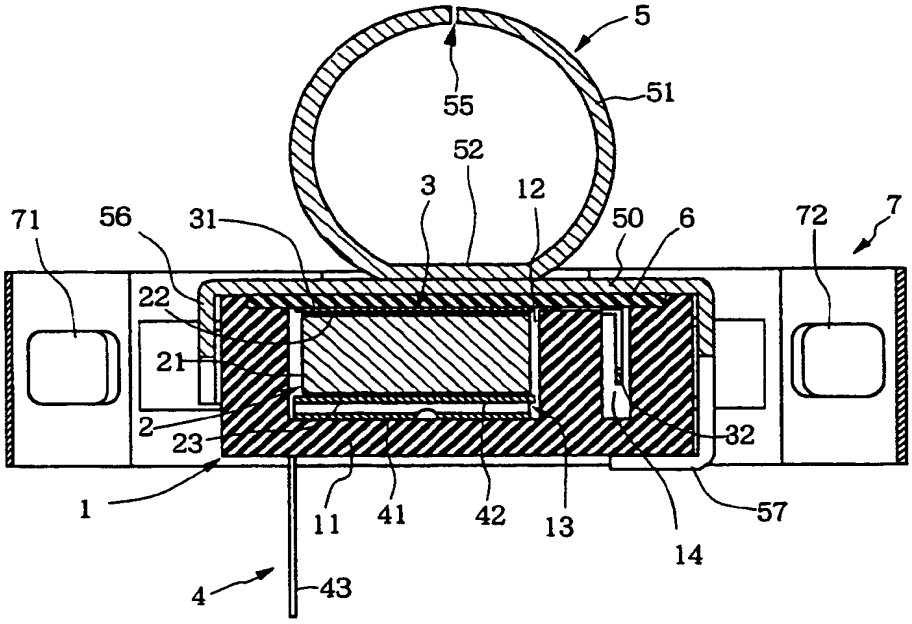


FIG. 13



INTERNATIONAL SEARCH REPORT

International Application No PCT/JP92/00811

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl[5] H01C7/02

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	H01C7/02

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

Jitsuyo Shinan Koho	1926 - 1992
Kokai Jitsuyo Shinan Koho	1971 - 1992

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	JP, A, 3-64883 (Murata Mfg. Co., Ltd.), March 20, 1991 (20. 03. 91), Claim, Fig. 1 (Family: none)	1-3
PY	JP, A, 3-187178 (Murata Mfg. Co., Ltd.), August 15, 1991 (15. 08. 91), Claim, Fig. 1 (Family: none)	12-13
Y	JP, U, 1-92793 (TDK Corp.), June 19, 1989 (19. 06. 89), Fig. 1 (Family: none)	1-2, 12
PY	JP, Y2, 3-31041 (TDK Corp.), July 1, 1991 (01. 07. 91), Claim, Fig. 6 (Family: none)	9-10

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
September 22, 1992 (22. 09. 92)	October 13, 1992 (13. 10. 92)
International Searching Authority	**Signature of Authorized Officer**
Japanese Patent Office	

Form PCT/ISA/210 (second sheet) (January 1985)